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Thomas A. Enslow
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1225 Eighth Street, Suite 550
Sacramento, California 95814-4810

Dear Mr. Enslow:

Attached are my comments on the 2000 Mitigated Negative Declaration (2000 MND) and Addendum recently produced by the California Department of Housing and Community Development. At your request I have reviewed the worker health and safety elements of these documents, and my comments address their technical accuracy and validity.

I appreciate the opportunity to participate in this review. As the lead investigator for a 1989 Department of Health Services study of health hazards associated with CPVC pipe installation, I focused particular attention on whether that study's findings were interpreted appropriately and whether the data from that study were used in the 2000 MND and Addendum to fully and accurately inform the policy making process. In some cases the 2000 MND's interpretations and applications of our 1989 data were inappropriate; my comments outline these areas and indicate the appropriate interpretations. My review and my comments built on my earlier review in 1998 of the Draft Environmental Impact Report.

In my professional opinion, the findings of the current 2000 MND are not consistent with available data and with established practices of industrial hygiene and health risk assessment. Workers installing CPVC potable water pipe can be expected to regularly experience exposures in excess of established exposure limits. Such exposures can be expected under conditions of normal use. Exposures will not uncommonly be in the range previously associated with adverse health effects in humans and with cancer in laboratory animals. These exposures, and their potential health effects, must be considered significant.

My detailed comments, analyses, and conclusions are attached.

Sincerely,

Jim Bellows, PhD, MPH

Comments on Addendum to the Mitigated Negative Declaration – CPVC Pipe in Residential Structures

Based on a thorough review of the "Addendum to the November 2000 Final Environmental Mitigated Negative Declaration" ("Addendum") regarding expanded use of chlorinated polyvinyl chloride (CPVC) pipe in residential structures, along with supporting documents and other relevant materials, my analysis, comments, and conclusions are as follows.

1. There is substantial evidence that the installation of CPVC may expose workers to dermal and inhalation health hazards.

The best available information regarding worker exposures during CPVC installation remains that from a 1989 study by the California Department of Health Services (DHS), of which I was the principal author.[1] The 1989 study included observation of CPVC pipe installation at 35 construction sites, extensive environmental and biological monitoring, and a review of relevant toxicity information then available.

The report concluded that workers installing CPVC pipe are exposed above legal limits to the combination of solvents in CPVC primer and cement – including tetrahydrofuran (THF), methyl ethyl ketone (MEK), cyclohexanone (CHX) and acetone (ACE). Workers installing CPVC pipe had inhalation exposures 1.8-8.5 times higher than workers installing over types of plastic pipe. The likelihood of overexposure above the full-shift exposure limit was estimated to be 10% for a typical work day of installing CPVC pipe for potable water in residential construction. The likelihood of overexposure above the short-term exposure limit at least once in a typical eight-hour work day was estimated to be 68%. Urine monitoring provided strong evidence that dermal absorption contributed substantially to some workers' overall exposure.

The 1989 DHS study also included exposure monitoring during installation of copper water pipe, and found that exposures to copper, tin, silver, antimony, and lead – the agents of principal concern during soldering – ranged from 0.2% to 4% of established exposure limits.

In 1998, I reviewed all available information in analyzing the incomplete 1998 Environmental Impact Report (EIR), and found no evidence that contradicted the original DHS conclusion that worker exposures above the legal limits must be expected frequently during installation of CPVC pipe using typical

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[1] Bellows, et al., 1989; California Department of Health Services.

products and work practices. Furthermore, my 1998 review found that a 1996 cancer bioassay study on THF conducted by the National Toxicology Program raised significant new questions on the potential health impacts on workers of cumulative long-term exposures. I concluded that the potential health impact to workers from the statewide approval of CPVC cannot be fully assessed without explicitly considering cumulative effects of long-term exposure, increased frequency of exposure and concurrent exposures.

I have again reviewed all available information, including the 2000 Mitigated Negative Declaration (2000 MND) and the Addendum, and conducted a literature search of on-line databases. Once again I find no evidence that contradicts the original DHS conclusion that overexposures above legal limits must be expected. The exposure limits for CPVC primer and cement solvents have not changed since the 1989 report, and knowledge about the toxicity of these solvents has evolved little. No new information about actual exposure levels during CPVC installation has become available.

The Department of Housing and Community Development (HCD), in the 1998 Draft EIR, acknowledged the health impact of CPVC installation, stating: "Workers not following safe use recommendations or using improper materials can be injured, and the Lead Agency considers this to be the worst case situation."[2] And the DHS experts then advising HCD on preparation of the incomplete 1998 EIR wrote: "Case reports point to the likelihood that overexposure related to poor ventilation has already led to illness in pipe workers."[3]

2. The Addendum and the 2000 Mitigated Negative Declaration cannot be based on the flawed analysis in the incomplete 1998 EIR.

Neither the 2000 MND nor the Addendum contained any new evidence or meaningful analysis. To the extent that the Addendum or the 2000 MND relied implicitly on the analysis in the incomplete 1998 EIR, such reliance would be misplaced for many reasons.

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[2] 1998 Draft EIR, p. 69.

[3] Comments of Elizabeth Katz, MPH, Acting Chief, Hazard Identification System and Information Service, Department of Health Services, June 11, 1998.

a. *The incomplete 1998 EIR reached the inappropriate conclusion that exposure to copper and other metals at levels far below the legal limits would be less significant than exposure to CPVC solvents at levels above legal limits.*

The lead agency for the 1998 EIR had no valid basis for simply discounting overexposures to any toxic material above the legal exposure limits, especially exposure limits that have been duly promulgated by another State agency, the Department of Industrial Relations. An argument advanced in the 1998 EIR was that the relative hazards of CPVC and copper pipe installation could be considered similar because the relevant Material Safety Data Sheets had similar recommendations for safe use.[4] The reasoning behind this argument was entirely invalid; safety recommendations frequently advise use of gloves, eye protection, and ventilation or respiratory protection simply because skin, eyes, and lungs are primary routes of exposure to toxic chemicals. Use of gloves, eye protection, and ventilation or respiratory protection is standard for a vast spectrum of substances, ranging from essentially harmless to highly toxic. If the lead agency wished to show then – or now – that the harmful impacts of increased CPVC use would be offset by the beneficial impacts of decreased copper pipe use, the valid approach would be through a careful, quantitative assessment of comparative risk. Such an assessment has apparently not been conducted. CPVC overexposures in excess of legal limits must be considered significant.

b. *The incomplete 1998 EIR based its conclusions in part on the unlikely scenario that workers would begin following all recommended safety practices, rather than the exposures that would occur under observed working conditions.*

The incomplete 1998 EIR repeatedly referred to exposure levels that might occur if workers consistently followed recommended safety practices such as avoiding skin contact with primers and cements.[5] Those references were misleading, since by then it had been documented that workers typically did not follow those recommendations, and the 1998 EIR gave no reason to believe that their adherence would increase.

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[4] Final 1998 EIR, p. 86.

[5] Final 1998 EIR, p. 61.

c. *The incomplete 1998 EIR incorporated flawed statements about DHS findings and conclusions related to hazards associated with CPVC installation.*

In attempting to justify its conclusions, the incomplete 1998 EIR misrepresented DHS work on CPVC. It cited a 1980 DHS report that was based on the little actual exposure monitoring available at that time,[6] even though that earlier report's findings were later shown to be incorrect by the extensive exposure monitoring for the 1989 DHS study. The incomplete 1998 EIR failed to cite DHS findings demonstrating extensive dermal absorption of CPVC primer and cement solvents, instead citing at length industry comments that attempted to dismiss the significance of urine monitoring.[7] Those comments were misinformed, and contrary to accepted industrial hygiene practices regarding the value of biological monitoring. Interestingly, the American Conference of Governmental Industrial Hygienists has since established a Biological Exposure Index for THF in urine following occupational exposure, affirming the importance of biological monitoring for this substance.

3. The proposed mitigation measures cannot be assumed to prevent worker health and safety impacts.

Since the incomplete 1998 EIR and my review and comment at that time, worker safety provisions for CPVC installation have been incorporated into the California Plumbing Code and the standards of the International Association of Plumbing and Mechanical Officials. Many of these provisions can be traced back to recommendations in the 1989 DHS study. Incorporating these provisions in the relevant codes is a step in the right direction, but is in itself unlikely to eliminate unsafe exposures during CPVC installation.

The chief limitation is that putting worker safety provisions into the relevant codes provides no assurance that most contractors or workers will heed them. Indeed, there is now evidence to the contrary. A survey conducted after the California legislature created a role for local building officials in overseeing health and safety associated with CPVC installation showed that most local building officials are aware of the CPVC worker safety provisions in the California Plumbing Code but that the overwhelming majority were failing to enforce those provisions.[8] And a recent report, seven years later, has shown that most workers

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[6] Final 1998 EIR, p 55.

[7] Final 1998 EIR, . 159.

[8] Stephen K. Hopcraft, 1998; AB 151 Health and Safety Measure Enforcement Survey Report.

still do not follow the worker safety provisions.[9] No evidence to the contrary is available.

I note the failure of this worker safety role for local building officials with some regret, because I played a role in creating it. To my knowledge, the first mention of a role for local building officials in enforcing worker safety provisions was in correspondence between DHS and HCD in 1990.[10,11] I was intimately involved in drafting that correspondence and in the internal DHS discussions that led to the recommendation. In advising HCD on how best to address worker safety in the 1990 EIR, the DHS thinking at the time was as follows. The California Department of Industrial Relations was (and is now) the lead agency for occupational health and safety regulation, but we were skeptical that it could have a useful role in mitigating hazards associated with CPVC installation. Its rulemaking process was then (and is now) slow and cumbersome, and HCD could offer no assurance in the EIR that it would enact regulations protecting workers from hazards associated with CPVC installation. Further, its enforcement of chemical exposure regulations then (and now) rarely extended to the construction industry, so even if regulations were promulgated they might have little real impact. So DHS proposed the role for local building officials both because HCD had the authority for creating such a role and because we hoped the frequent presence of local building officials at construction sites might create an opportunity for them to impact working conditions there. Unfortunately, the evidence since then shows that this hope was unrealistic.

In light of the of the ineffectiveness of the mitigation measures in the 2000 MND, the true impact of the any proposed mitigation measures must be evaluated before they can be considered effective and reliable in reducing worker health impacts. The technical merits of any proposed worker safety measure – from gloves to ventilation to product reformulation – are not sufficient in understanding whether the measures will result in any real exposure reduction. This is particularly true where economic or social factors are involved that could interfere with implementation. Virtually all the worker safety provisions proposed for CPVC installation involve such factors. For example: Many workers find wearing chemical protective gloves to be uncomfortable and to slow their work. Some workers believe incorrectly that any type of gloves will provide protection. Workers under pressure to complete a job quickly may not take care to minimize

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[9] Robert Calzone, 2005; investigative report

[10] Memorandum of Richard Jackson, MD, then Chief of the Office of Environmental Health Hazard Assessment, 1990; p. 4.

[11] Memorandum of Stephen A. Book, PhD, then Chief of the Health Hazard Assessment Division, 1990; p. 3.

or clean up spills, or to set up ventilation when their CPVC installation must be done in enclosed spaces. Cement manufacturers must consider the reliability of a pipe cement system as well as worker safety aspects, and so retain primers and solvents that would be eliminated if worker safety was the overriding concern. Regulatory agencies must stretch constrained enforcement resources.

The point is not that regulation and other mitigation measures have no useful role. Indeed, they are essential in preventing overexposure to toxic substances. Rather, the point is that new regulations cannot simply be assumed to be effective in changing work practices, especially when previous regulations have been ineffective. Further study is needed to understand exactly why the previous measures had limited success and what, if anything, can be done to improve the effectiveness of future mitigation measures.

Until the effectiveness of any proposed mitigation measures is demonstrated, the significance of worker health effects must be judged on the basis of observed work practices and exposure levels. Assuming that untested measures will be effective would be wishful thinking.

4. Significant health impacts must be anticipated if use of CPVC pipe is expanded, using the standard of likely exposures above legal limits.

The preceding evidence and analysis supports three conclusions:

a. *The best evidence indicates that CPVC installation under typical working conditions results in frequent overexposures above legal limits.*

b. *Overexposures to toxic substances above legal limits cannot be dismissed and must be considered significant.*

c. *The best evidence indicates that mitigation measures under the 2000 MND have been ineffective, so these measures cannot be assumed to effectively reduce exposures in the future.*

Together, these lead to the inescapable overall conclusion that expanded use of CPVC pipe as proposed in the Addendum must be expected to lead to worker overexposures above existing legal limits, regardless of unproven mitigation measures, and that these overexposures must be considered significant impacts.

5. Additional mitigation measures could further reduce the frequency and severity of overexposures.

While no mitigation measures have demonstrable ability to reduce exposures during CPVC installation to the level of insignificance, any review of worker safety hazards associated with CPVC installation merits consideration of measures that could at least prevent the most severe overexposures. The 2000 MND and ensuing experience with its mitigation measures provide useful information about the limitations of those measures. The following measures have been proposed previously and have not yet been acted upon, or else build on experience with the mitigation measures in the 2000 MND.

a. Require one-part no-primer cements.

The 1989 DHS study noted that the highest worker exposures occurred with heavy use of primers. The incomplete 1998 EIR asserted that one-part cements eliminated the need for primers and thus could reduce worker exposures during CPVC installation, but did not take the obvious step of requiring such cements as a mitigation measure. As a result, primers continue to be used, and associated exposures continue.[12] Banning primers would seem to be an obvious step to take to protect workers from undue health impacts.

b. Require small containers and small daubers.

The 1989 DHS study also noted that high exposure sometimes occurred when workers used large daubers for primer or cement – because large daubers transport more solvents out of their containers into workers' breathing zones – and that high exposures sometimes occur when containers spill. But neither the incomplete 1998 EIR nor the 2000 MND specifically required small containers or small daubers. Requiring small containers and small daubers is unlikely to have dramatic effect on worker exposures, but at least would have the advantage of being enforceable without observation of work practices. A local building official or Cal/OSHA compliance officer would only need to inspect a contractor's supplies to assure compliance.

c. Improve and expand worker training.

Most other mitigation measures, including use of gloves and ventilation or respiratory protection, will ultimately be most effective if the affected work force understands the hazards associated with CPVC installation and the importance

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[12] Robert Calzone, 2005; investigative report.

of following all required or recommended worker safety provisions. The best path to understanding is regular, high-quality worker safety training. The training provisions of the 2000 MND were laudable, but they were apparently inadequate to accomplish the objective of getting workers sufficiently trained that they comply with the worker safety provisions. One option for improving the quality of worker safety training programs would be to set specific minimum standards for the content of training programs and require that the programs be certified. This approach has been used in regulating training for exposures associated with lead paint abatement, another toxic exposure that occurs in dispersed construction sites rather than a fixed manufacturing facility.

d. Establish adequate funding or personnel to ensure genuine enforcement of required mitigation measures.

To date neither Cal/OSHA nor local building officials have apparently been successful in changing worker practices during CPVC installation, even though both have regulations requiring improved practices. In all likelihood, a key limitation is that Cal/OSHA and local building officials face the challenge of trying to enforce many regulations with severely constrained resources. If HCD truly intends to reduce worker health impacts by improving compliance with worker safety provisions, it will need to assure that adequate enforcement resources are make available.

e. Establish a monitoring system to improve enforcement of all relevant standards, especially those regarding gloves and ventilation.

One lesson of experience with the 2000 MND mitigation measures is that they may not have the desired impact, regardless of how well intentioned they may be. To the extent that any new action allowing expanded use of CPVC relies on mitigation measures to control worker health impacts, it will be essential to establish a mechanism for monitoring the measures' effectiveness over time and for making any modifications that may be necessary to achieve the measures' objectives.

6. Conclusion

Understanding of the worker health impacts associated with CPVC pipe installation has evolved little over the sixteen years since comprehensive 1989 DHS study. Legal arguments and expert opinions have accumulated, but there is little new evidence and there have been no subsequent in-depth investigations or analyses. The most significant new evidence available since the incomplete 1998 EIR and the 2000 MND is that mitigation measures – written into IAPMO

standards and the California Plumbing Code – seem to have had little effect in changing typical CPVC installation practices.

As a result, conclusions based on this evidence can be no different than in previous analyses: Workers who install CPVC pipe are likely to be overexposed to toxic primer and cement solvents above the legal limits on a regular basis. These overexposures above legal limits must be considered significant. The mitigation measures imposed by the 2000 MND have not been effective in changing work practices to date, and there exists no evidence that they will be more effective in the future. Additional mitigation measures could be considered, not because they can reasonably be expected to reduce worker health impacts to the level of insignificance but because they offer a prospect of limiting somewhat the significant impacts that must be expected.